

Claims

What is claimed is:

- Sub. a1*
1. A method for tracking the location and movement of an object near a machine at a site, including the steps of:
    - determining a position of the machine;
    - determining a position of the object;
    - transmitting the determined position of the object from the object to the machine; and
    - displaying the position of the object relative to the position of the machine to an operator of the machine.
  2. A method, as set forth in claim 1, further including the step of transmitting an identification code of the object from the object to the machine.
  3. A method, as set forth in claim 2, further including the step of displaying an identification of the object to the operator of the machine.
  4. A method, as set forth in claim 2, further including the step of identifying the object as being one of a person and a mobile vehicle.
  5. A method, as set forth in claim 1, further including the steps of:
    - tracking the movements of the machine and the object relative to the machine; and
    - displaying the movements of the machine and the object to the operator of the machine.

6. A method, as set forth in claim 1, further including the step of transmitting a differential global positioning satellite (DGPS) signal from the machine to the object, and wherein the object receives the DGPS signal and responsively determines the position of the object.

7. A method, as set forth in claim 1, further including the step of notifying the operator of the machine in response to an other object approaching a proximate area in which the machine is located.

8. A method, as set forth in claim 7, further including the steps of:

determining a position of the other object;

transmitting the position and an identification code of the other object from the other object to the machine; and

displaying the position and the identification of the object and the other object relative to the position of the machine to the operator of the machine.

9. A method, as set forth in claim 8, further including the step of transmitting the positions and the identification codes of the object and the other object from the machine to at least one of an other machine and a remote site.

10. A method, as set forth in claim 1, further including the steps of:

determining a level of accuracy of the determined position of the object; and

increasing a size of a display of the object to the operator of the machine in proportion to a decrease in the level of accuracy of the determined position.

11. A method, as set forth in claim 1, further including the step of notifying the operator of the machine in response to a decrease in a level of confidence of the determined location of the object.

12. A method, as set forth in claim 8, further including the step of removing the display of the position of the other object in response to the other object leaving the proximate area.

13. A method, as set forth in claim 1, further including the step of activating a back-up alarm located on the object to indicate a condition of the machine moving in a backwards direction.

14. An apparatus for tracking the location and movement of an object near a machine at a site, comprising:

a first position determining system located on the object;  
a first transmitting and receiving system located on the object;  
a second transmitting and receiving system located on the machine;

a display located on the machine; and

a controller located on the machine;

wherein the controller receives position information of the object transmitted from the first transmitting and receiving system to the second transmitting and receiving system, and responsively provides information to the display to indicate the location and movement of the object relative to the machine.

15. An apparatus, as set forth in claim 14, wherein the object is a person.

16. An apparatus, as set forth in claim 14, wherein the object is a mobile vehicle.

17. An apparatus, as set forth in claim 14, wherein the object includes a plurality of objects, including at least one of a plurality of persons, a plurality of mobile vehicles, and a combination of persons and mobile vehicles.

18. An apparatus, as set forth in claim 14, wherein the machine is a work machine adapted to move about the site.

19. An apparatus, as set forth in claim 14, wherein the first position determining system includes a global positioning satellite (GPS) system.

20. An apparatus, as set forth in claim 14, wherein the object is a person, the first position determining system includes a global positioning satellite (GPS) system, and the first transmitting and receiving system includes at least one antenna, a transmitter, and a receiver; and further including a power source located on the person; wherein the GPS system, the first transmitting and receiving system, and the power source are portable units located on the person as the person moves about the site.

21. An apparatus, as set forth in claim 14, wherein the object is a mobile vehicle, the first position determining system includes a global positioning satellite (GPS) system, and the first transmitting and receiving system includes at least one antenna, a transmitter, and a receiver; and further including a

power source located on the mobile vehicle; wherein the GPS system, the first transmitting and receiving system, and the power source are portable units located on the mobile vehicle as the mobile vehicle moves about the site.

22. An apparatus, as set forth in claim 18, further including a second position determining system located on the machine.

23. An apparatus, as set forth in claim 22, wherein the second position determining system is a global positioning satellite (GPS) system, and wherein the machine further includes a means for delivering a differential global positioning satellite (DGPS) signal to the object.

24. An apparatus, as set forth in claim 14, further including means for generating an identification code for the object.

25. An apparatus, as set forth in claim 18, wherein the second transmitting and receiving system includes at least one antenna located on the machine such that communications between the machine and the object are allowed for any location of the object near the machine.

26. An apparatus, as set forth in claim 18, further including a back-up alarm located on the object to indicate a condition of the machine moving in a backwards direction.

27. An apparatus, as set forth in claim 14, wherein the first transmitting and receiving system is a short-range system, and further including a third transmitting and receiving system located on the object, the third transmitting and receiving system being a long-range system.

28. A method for tracking the location and movement of an object near a machine at a site, including the steps of:
- determining a position of the machine;
  - establishing a proximate area in which the machine is located;
  - determining a position of the object;
  - transmitting the determined position of the object from the object to the machine;
  - determining the object to be approaching the proximate area; and
  - displaying the position of the object relative to the position of the machine to an operator of the machine.
29. A method, as set forth in claim 28, further including the steps of:
- determining the object to be leaving the proximate area; and
  - removing the display of the object.
30. A method for tracking the location and movement of an object near a machine at a site, including the steps of:
- determining a position of the machine;
  - determining a position of the object, the object being one of a person and a mobile vehicle;
  - transmitting the determined position of the object from the object to the machine;
  - transmitting an identification code of the object from the object to the machine; and
  - displaying the position of the object relative to the position of the machine and the identification code of the object to an operator of the machine.

31. A method for providing a machine with the location and movement of an object near the machine at a site, the location and movement of the object being determined by the object, including the steps of:

receiving a global positioning satellite (GPS) signal;  
determining a position of the object as a function of the GPS signal;  
transmitting the determined position to the machine; and  
transmitting an identification code to the machine.

32. A method, as set forth in claim 31, further including the steps of:

receiving an alarm signal from the machine indicative of an alarm condition; and  
responsively activating an alarm at the object.

33. An apparatus for tracking the location and movement of a person near a machine at a site, comprising:

a first position determining system located on the person;  
a second position determining system located on the machine;  
a first transmitting and receiving system located on the person;  
a second transmitting and receiving system located on the machine;

a display located on the machine; and

a controller located on the machine;

wherein the controller receives position information and an identification code from the person transmitted from the first transmitting and receiving system to the second transmitting and receiving system, and responsively provides information to the display to indicate the location and

movement of the person relative to the machine, and to further indicate the identification code of the person.

34. An apparatus for tracking the location and movement of a mobile vehicle near a machine at a site, comprising:

a first position determining system located on the mobile vehicle;  
a second position determining system located on the machine;  
a first transmitting and receiving system located on the mobile vehicle;

a second transmitting and receiving system located on the machine;

a display located on the machine; and  
a controller located on the machine;  
wherein the controller receives position information and an identification code from the mobile vehicle transmitted from the first transmitting and receiving system to the second transmitting and receiving system, and responsively provides information to the display to indicate the location and movement of the person relative to the machine, and to further indicate the identification code of the mobile vehicle.

35. An apparatus, as set forth in claim 34, wherein the first position determining system and the first transmitting and receiving system are portably located on the mobile vehicle in response to the mobile vehicle entering the site.

36. A method for tracking the location and movement of an object near a machine at a site, including the steps of:

determining a position of the machine;  
determining a position of the object;

initiating communications between the object and the machine in response to the object approaching a proximate area in which the machine is located;

displaying the position of the object relative to the position of the machine to an operator of the machine; and

terminating communications between the object and the machine in response to the object leaving the proximate area.

37. A method, as set forth in claim 36, further including the steps of:

communicating an identification code from the object to the machine; and

displaying the identification code to the operator of the machine.

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